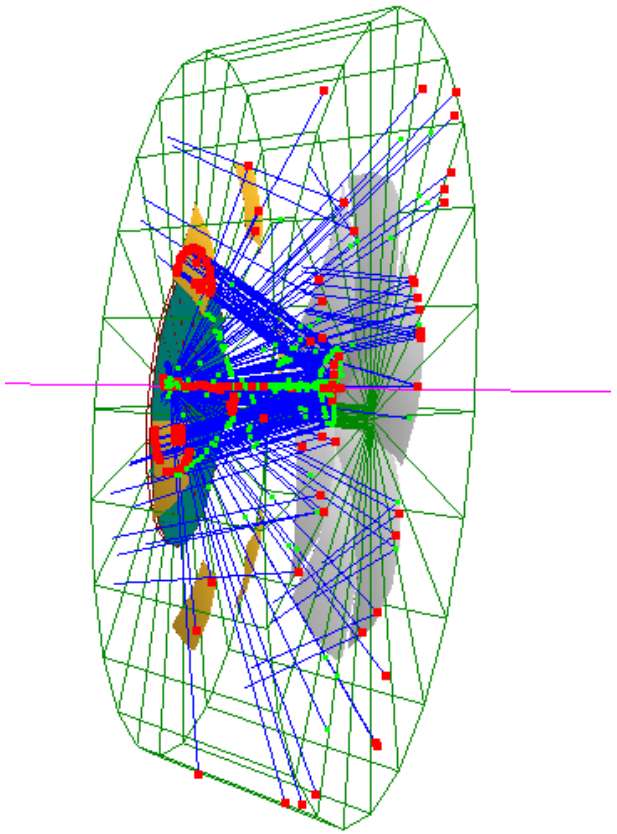
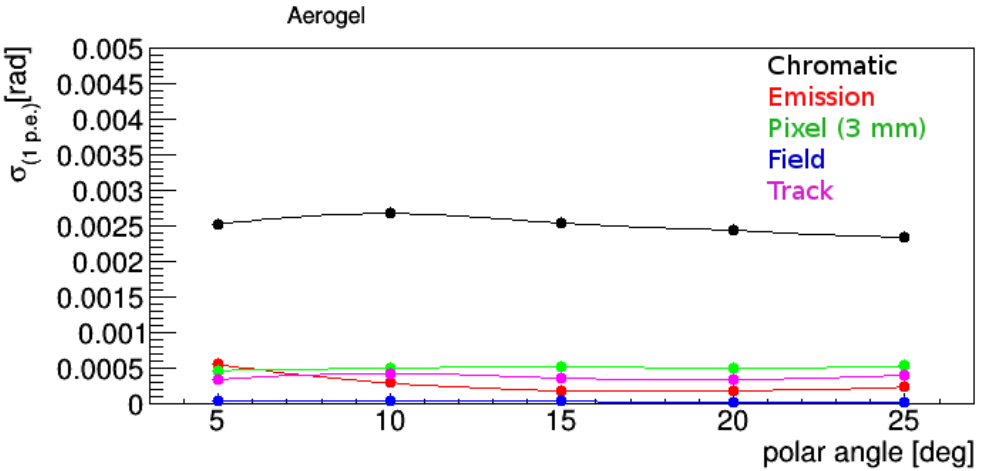
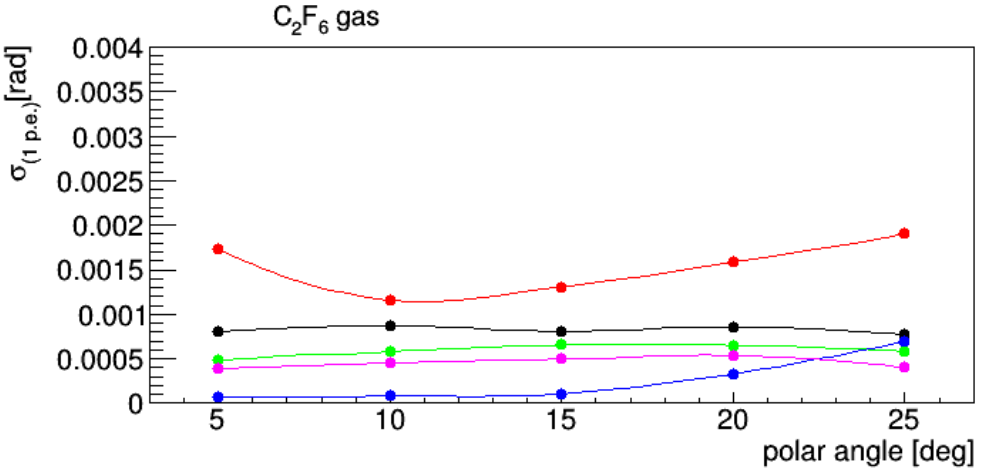
Dual-radiator RICH: update

Alessio Del Dotto for the EIC PID/RICH collaboration
December 19, 2016

Resolution with the filter (aerogel + C_2F_6)



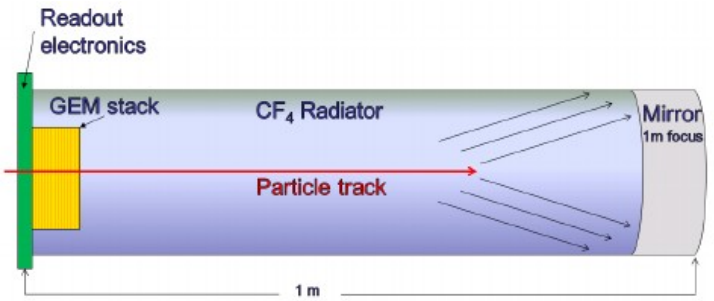




Number of p.e. for the gas – CF_4 (Hemmick prototype)

Performance of a Quintuple-GEM Based RICH Detector Prototype

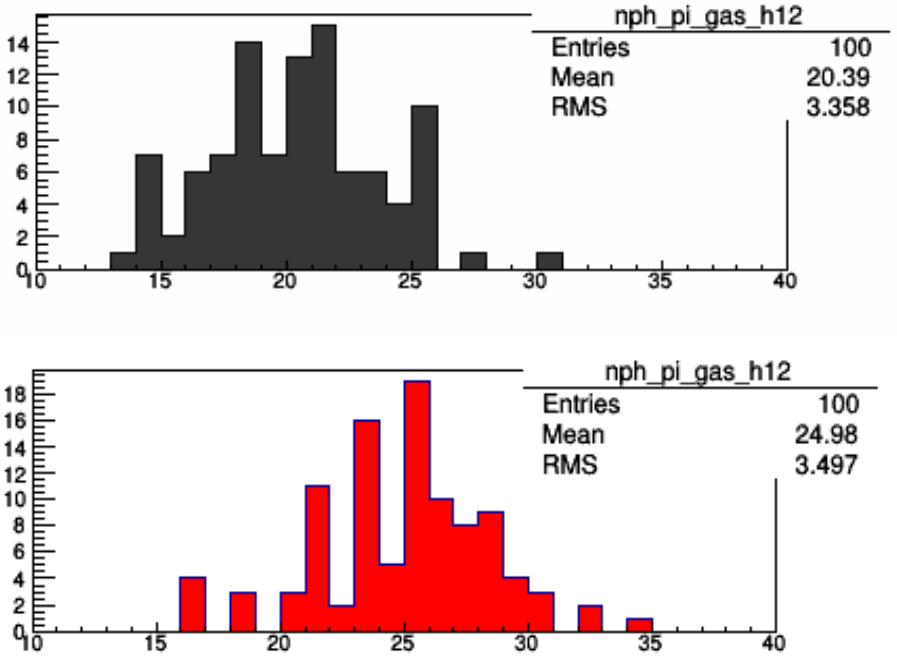
Marie Blatnik, Klaus Dehmelt, Abhay Deshpande, Dhruv Dixit, Nils Feege, Thomas K. Hemmick, Benji Lewis, Martin L. Purschke, *Senior Member, IEEE,* William Roh, Fernando Torales-Acosta, Thomas Videbæk, and Stephanie Zajac

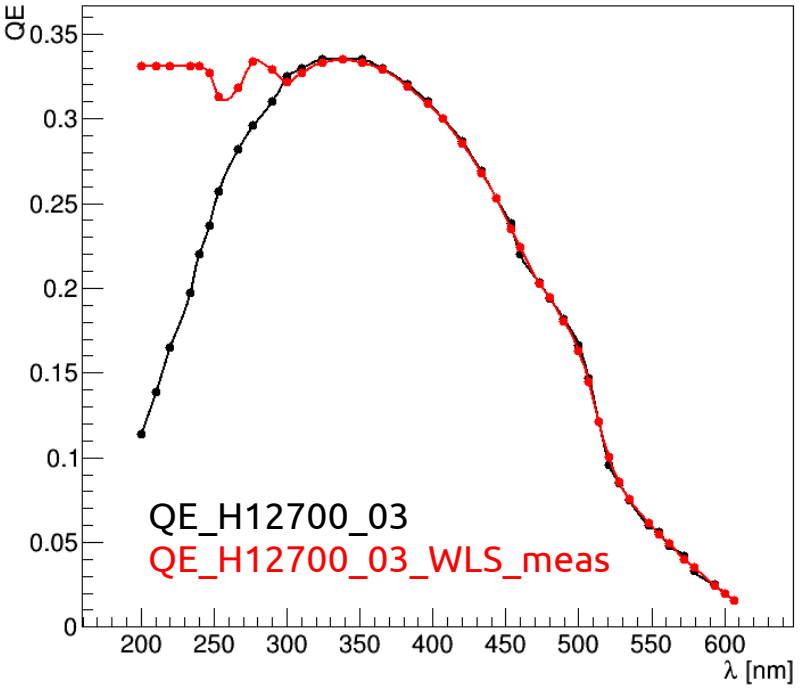


- They have about 12 p.e. for a pion of 32 GeV/c
- The expected value from the simulation was 16 p. e.

Number of p.e. for the gas – CF_4 (n = 1.000482)

$$p_\pi = 31\ GeV/c$$

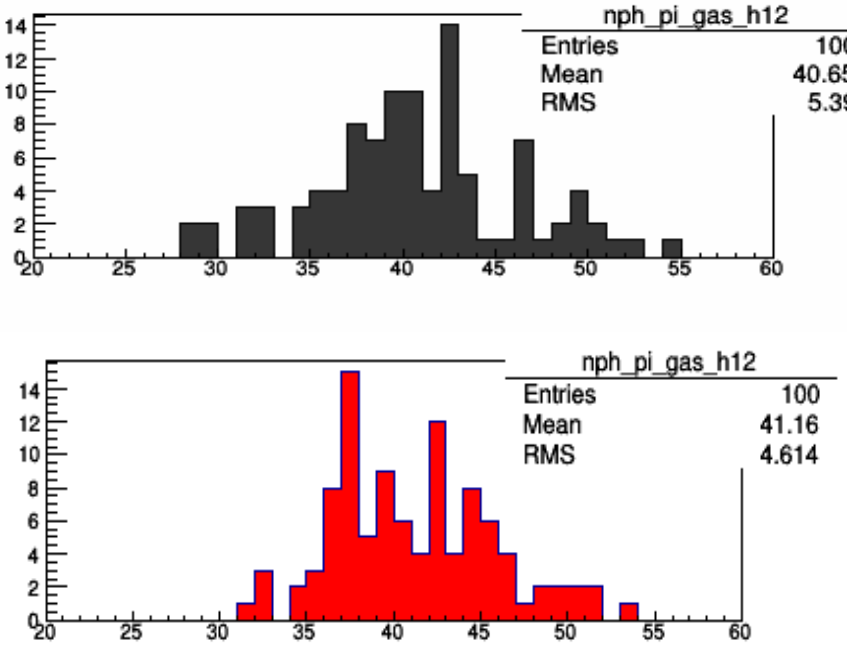


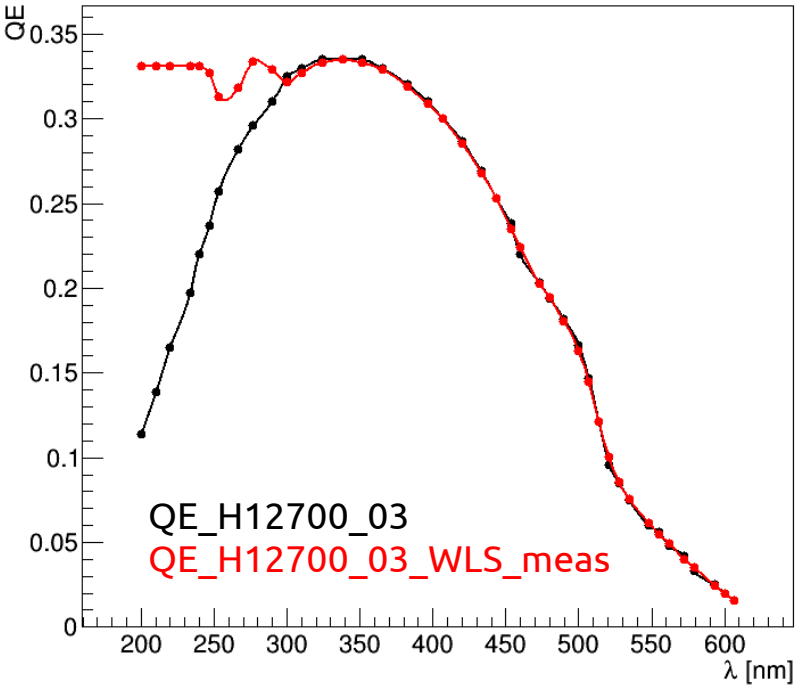


- Length of the gas tank about 1.6 m
- The Npe is obtained using all the efficiency factors: reflectivity, QE, photon pile up (pixel 3 mm), etc ...
- The above distributions are resized by 0.7*Npe, to be consistent with the experimental informations

Number of p.e. for the gas – C_2F_6 (n = 1.00086)

$$p_\pi = 31\ GeV/c$$

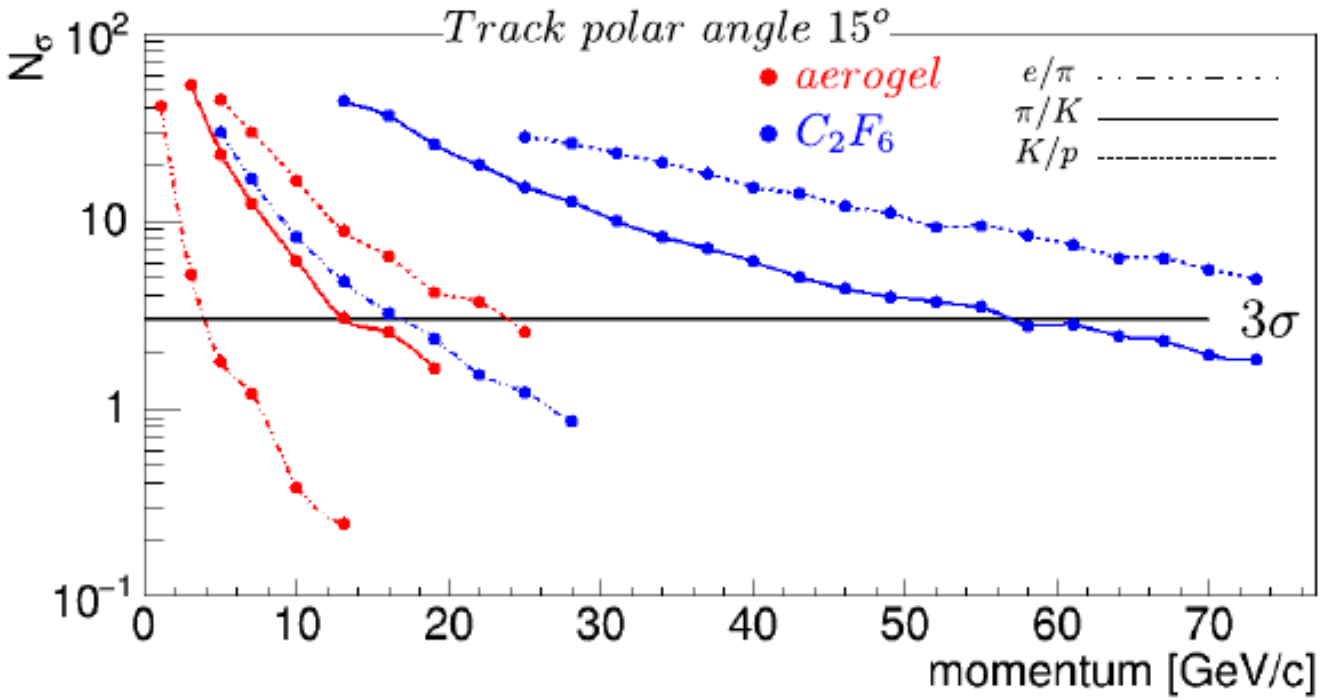


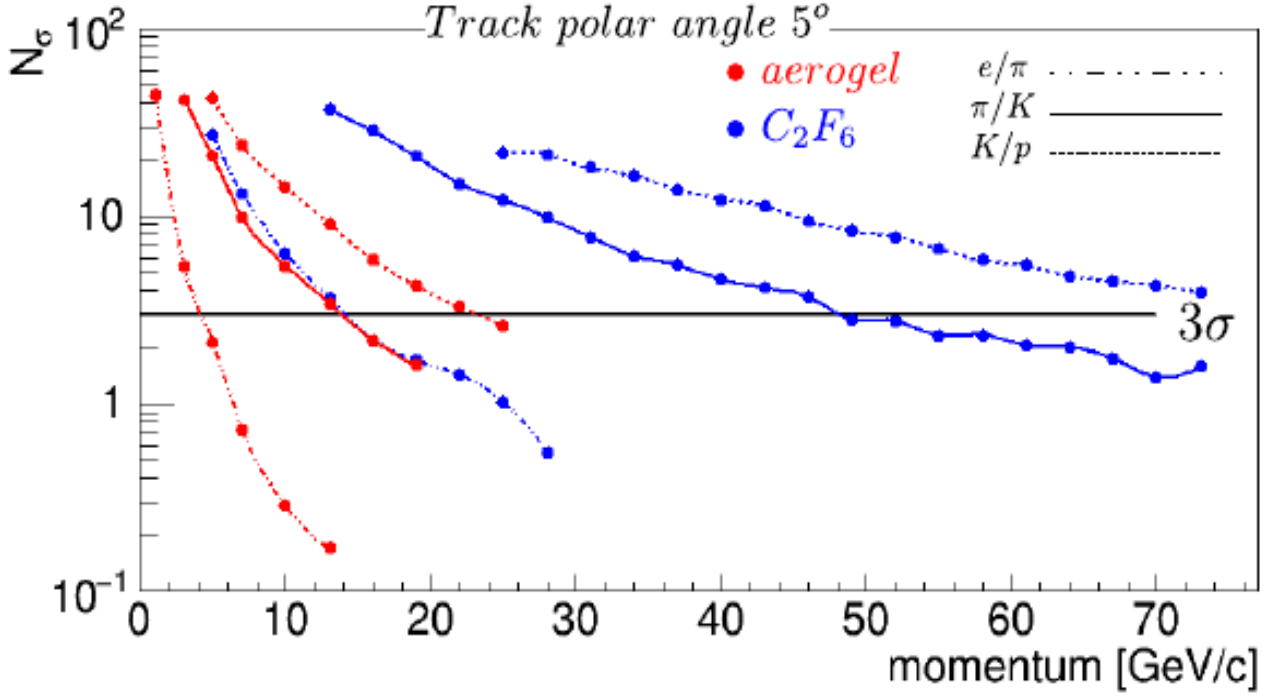


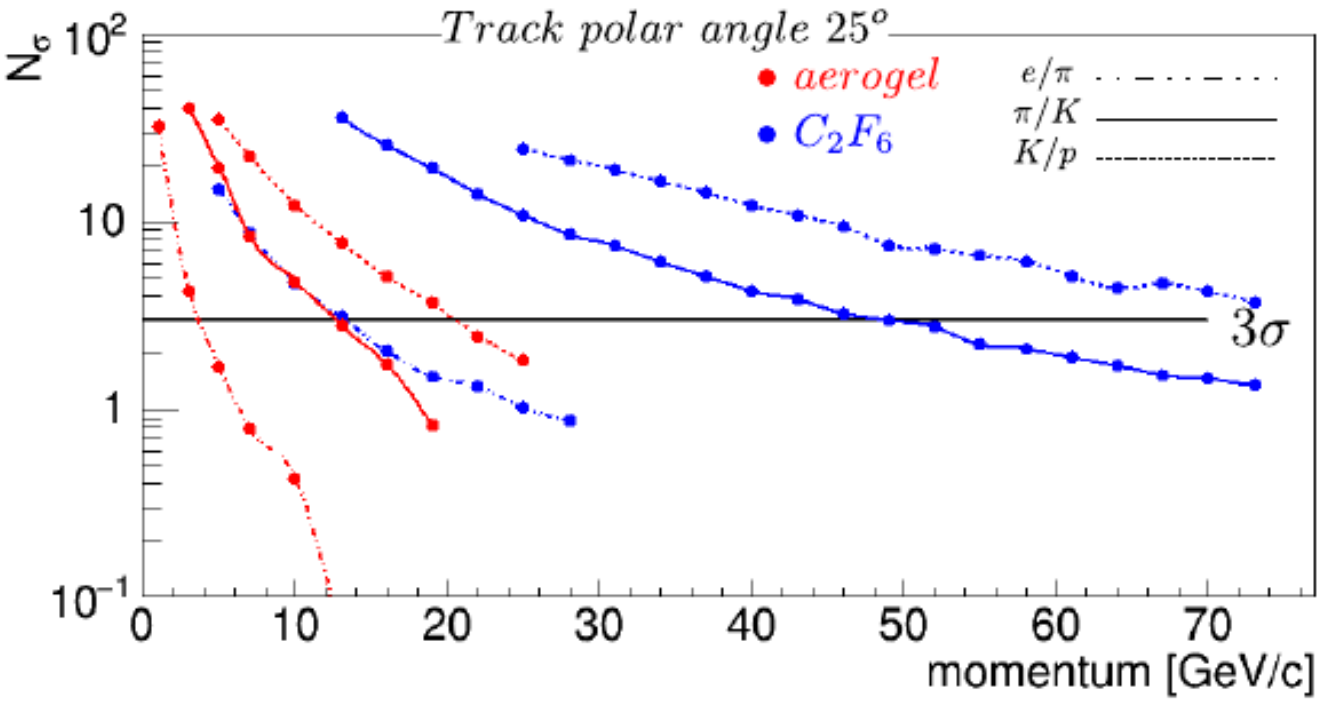
$$\lim_{\beta \to 1} N_{ph} = C \cdot L \cdot \epsilon(\lambda) \cdot \frac{n^2 - 1}{n^2} \propto \frac{n^2 - 1}{n^2}$$

- The above distributions are resized by 0.7*Npe, assuming the same normalization of CF_4

Performances with the filter (aerogel + C_2F_6)




Track polar angle 5°
N_σ
10^2
10
1
10^{-1}
aerogel
C_2F_6
e/π
π/K
K/p
3σ
0
10
20
30
40
50
60
70
momentum [GeV/c]


Track polar angle 25°
N_σ
10^2
10
1
10^{-1}
aerogel
C_2F_6
e/π
π/K
K/p
3σ
0
10
20
30
40
50
60
70
momentum [GeV/c]

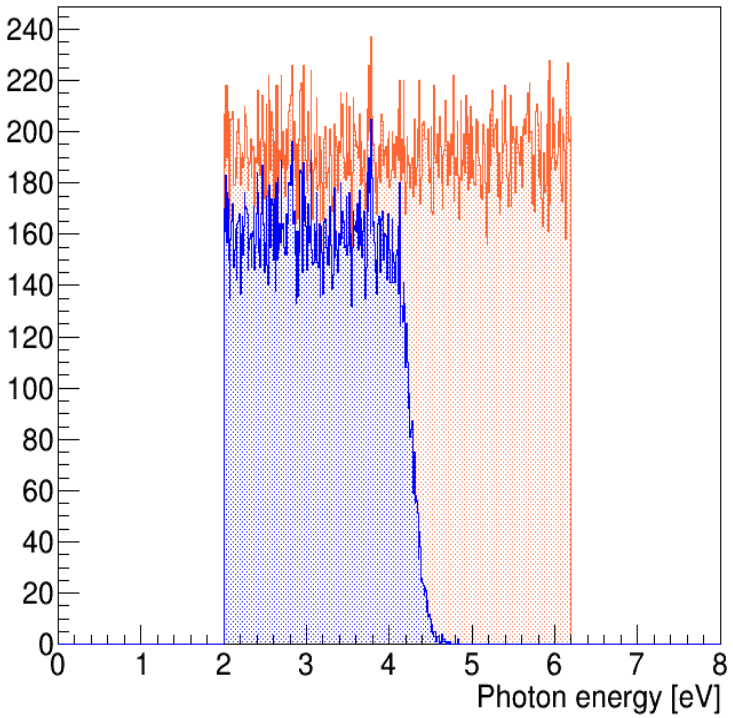
To do next

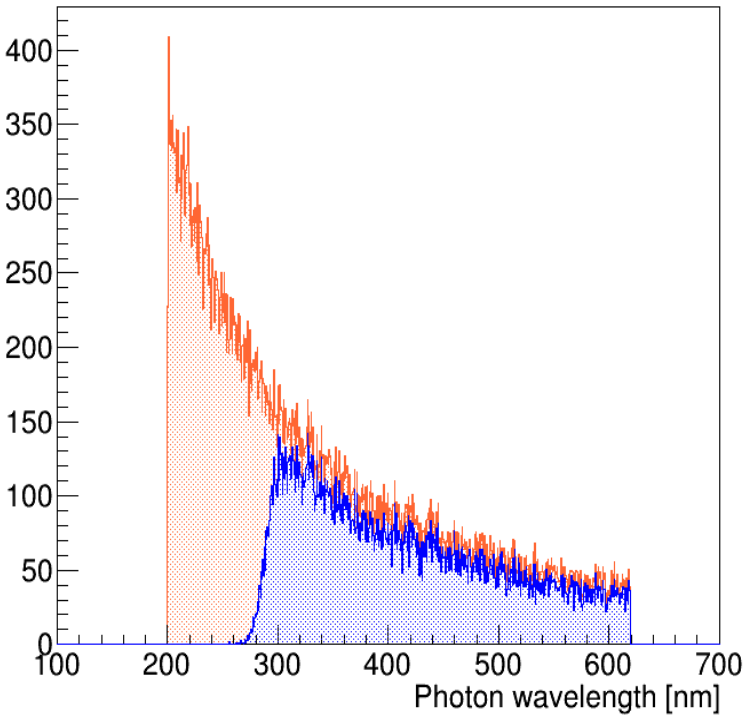
Next steps:

- Collaboration for BNL version of dual RICH
- Try to fit existing photo-detector devices on spherical a surface
- In general, To do list of FY17

Filtered spectrum

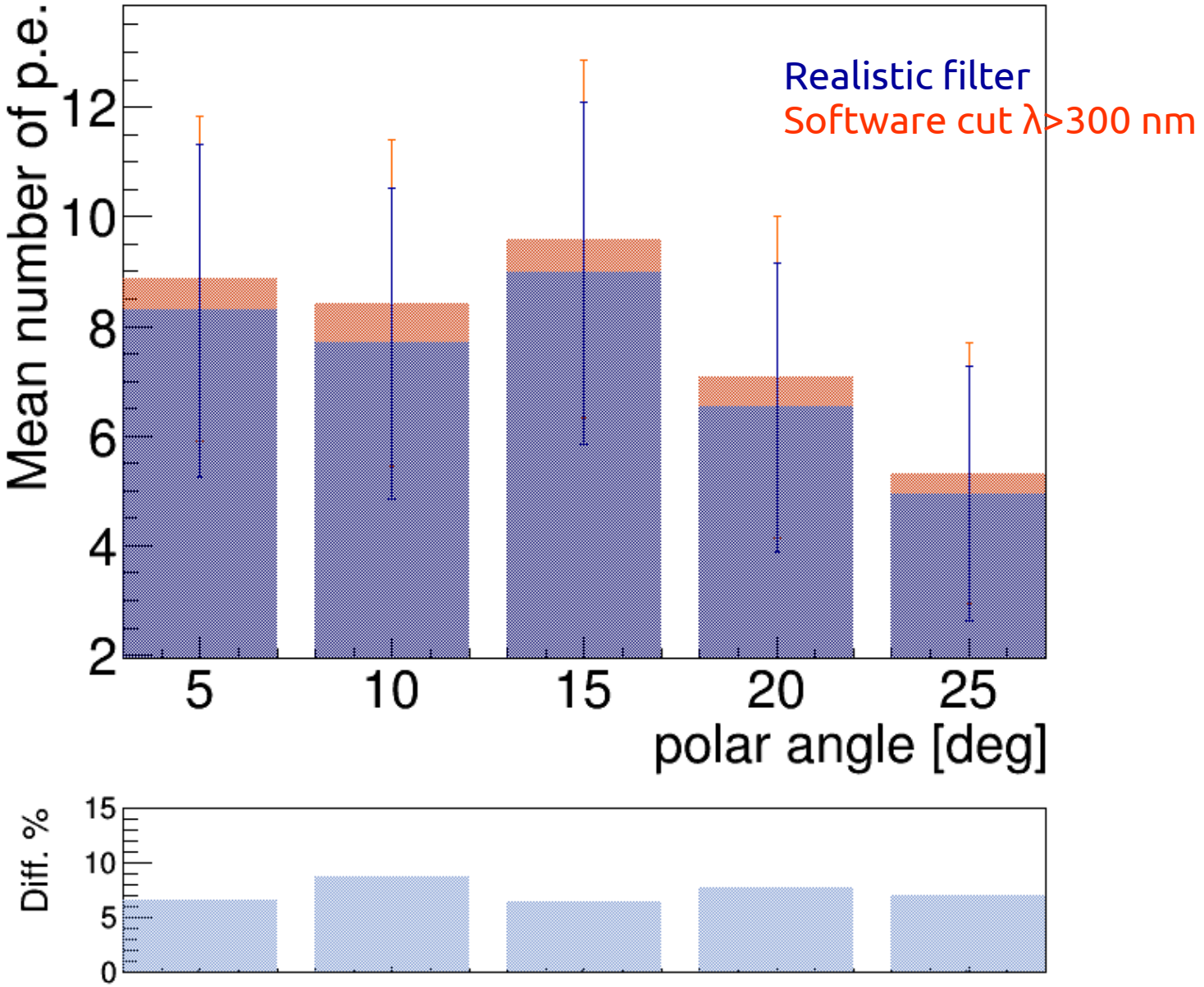
This is the effect of the shield on a beam of photons of
E = [2,6.2] eV





With the shield there is an additional absorption of photons, even in the good range!
A trade off is needed!

N_{pe} vs polar angle



Inefficiency vs polar angle

$$P(N_{ph} < 3) = \exp(-\langle N_{ph} \rangle)(1 + \langle N_{ph} \rangle + \langle N_{ph} \rangle^2 / 2)$$